# *AEROMET ENGINEERING, INC.*

1325 AEROTEC DRIVE JEFFERSON CITY, MISSOURI 65109 573-636-6393

## FAX NUMBER (573) 636-9767

### FAX TRANSMISSION

DATE: 12/02/02

TO: Rusty Keller

Doe Run

636-933-3150

FROM: BRAD ELLIS

PAGE NO. 1 of 10 PAGE(s)

**COMMENTS:**

30278545

ATTACHMENT 4

# I. INTRODUCTION

AeroMet Engineering, Inc., located in Jefferson City, Missouri, was retained by the Doe Run Company to determine the lead emissions from the Main Stack Exhaust at the Herculaneum Smelter in Herculaneum, MO. Emissions were sampled over a one day period (April 18, 2002) under steady-state operating conditions. The entire plant was operating under normal operating conditions. The Doe Run Company's Herculaneum Smelter is located at 881 Main Street, in Herculaneum, Missouri. The facility is an existing primary lead smelter. Many processes involving material handling are required to achieve lead smelting. The majority of the process emissions vent through the main stack. The emissions from the main stack were sampled at an outside location approximately 350 feet above ground level on a test platform.

Testing of the emissions was performed in accordance with the procedures specified in the Code of Federal Regulations (CFR), Title 40, Part 60, Appendix A, Method 12 -Determination of Inorganic Lead Emissions from Stationary Sources. Methods 1, 2, 3, and 4 were also performed in order to determine sampling points, exhaust gas velocities, exhaust gas molecular weight, and exhaust gas moisture content.

The test ports were installed at locations best suitable to meet the guidelines of EPA Method 1 - Sample and Velocity Traverses For Stationary Sources. Air flow characteristics were checked for presence of cyclonic flow as per Method 1 during a past testing program and it was found that cyclonic flow was not present. Access to the sample points was made possible by four ports. A total of 12 sample points were used with three sample points located on each of four ports. The test results should be representative of the actual emissions. Weather was not a factor during the testing program although all testing was performed outdoors. The skies were mostly clear and temperatures were in the 70's.

Jim Lanzafame of the Doe Run Company assisted in coordination of the test program. The test team was comprised of Tom Scheppers, P.E. and Mr. Brad Ellis, both of AeroMet Engineering, Inc. Mr. Doug Elley observed the test as an observer for the Missouri Department of Natural Resources.

# II. SUMMARY OF TEST RESULTS

The summary of production, gas flows, and lead emissions is presented in Table I. All results are based on the raw data shown in Appendix B–Raw Test Data. No process problems were encountered during the three runs of the test period.

All three test runs were performed at the main stack on April 18, 2002. The entire plant was operating under normal operating conditions. Testing for lead, velocity, gas analysis for molecular weight and moisture were performed simultaneously for all three runs during the period process exhaust gases were sampled. Visible emission readings were not required.

Visual observations of the collected samples indicated the appearance of a particulate coating on the filters for all three test runs. Particulate coating on each filter was similar for each of the three runs. All back half reagents recovered from the impingers were noted as clear with no noticeable discoloration.

All process equipment related to, and including, the main stack was operated in a manner representative of operations that may contribute to normal lead emissions. Operating production data can be found in Appendix D. Discussions of the process data can be found in Section IV– Plant Operating Conditions.

The isokinetic sampling rate is also shown in Table I. This rate compares the stack gas velocity to the nozzle velocity of the sampling probe. A rate of 100% represents a stack gas velocity equal to the nozzle velocity. The acceptable range is 90% to 110%. EPA has determined that sampling outside this range may cause a bias in the results based on the particle size and aerodynamic properties. All three of the test runs were conducted with an isokinetic rate within the acceptable range.

The lead emission results should be representative of the actual concentrations within the normal accuracies of Method 12. Although no upper limits of emissions have been established for the test method, an upper limit has not been exceeded based on acceptance of the test method on significantly higher grain loadings. Method 12 test procedures are based on Method 5 particulate sampling. The estimated accuracy of Method 5 is approximately +/- 20% based on results of collaborative tests.

## III. SOURCE DESCRIPTION

The Doe Run Company owns and operates a primary lead smelting facility in Herculaneum, Missouri. Many of the plant processes exhaust controlled emissions to atmosphere through a common 550-foot tall concrete stack, i.e., "the main stack". Table III lists the processes and approximate corresponding gas volumes that each exhausts to the main stack.

Exhaust air from the emission sources shown in Table III first pass through a particulate control device before they enter the main stack. Accordingly, the concentration of particulate matter present in the main stack exhaust gas stream represents controlled emissions from all of the individual emission units that contribute to the main stack exhaust gas flow. Similarly, the concentration of lead in the main stack exhaust also reflects controlled emissions.

Primarily, the plant operations, including the sinter plant, blast furnaces, and acid plant, operate on a 24 hour/day, 7 day/week schedule. The dross plant however operates as a batch-type process that runs repeatedly on a 24 hour/day basis. The only exception to this is when equipment is taken down for planned maintenance. Due to their relatively small percentage of gas flow contributed to the total stack flow, when most of these processes are down, they have little influence on the total flow and total main stack emissions. The exception to this is when the sinter plant is down.

# TABLE I

## DOE RUN COMPANY
## HERCULANEUM FACILITY
## PRODUCTION AND OPERATING TIME
## APRIL 2001-MARCH 2002

| | Tons of Lead Produced |
|---|---|
| April 2001 | 18,452.62 |
| May 2001 | 16,226.39 |
| June 2001 | 16,698.30 |
| July 2001 | 16,411.49 |
| August 2001 | 15,691.99 |
| September 2001 | 14,329.50 |
| October 2001 | 15,100.40 |
| November 2001 | 12,612.20 |
| December 2001 | 11,154.31 |
| January 2002 | 13,156.57 |
| February 2002 | 12,141.18 |
| March 2002 | 13,718.52 |
| **TOTAL:** | **175,693.47** |
| **Metric Tons (Tonnes):** | **159,386.44** |

**Blast Furnace Operating Time:** **8,647.44**

| **Sinter Plant Operating Time** | Hours |
|---|---|
| April 2001 | 583.05 |
| May 2001 | 667.05 |
| June 2001 | 531.25 |
| July 2001 | 638.10 |
| August 2001 | 644.30 |
| September 2001 | 509.35 |
| October 2001 | 501.16 |
| November 2001 | 464.61 |
| December 2001 | 397.06 |
| January 2002 | 528.50 |
| February 2002 | 336.78 |
| March 2002 | 395.92 |
| **TOTAL:** | **6197.13** |

**Weighted Plant Operating Time: 7,422.29**

# TABLE II

## DOE RUN COMPANY
### HERCULANEUM FACILITY
### SUMMARY OF LEAD EMISSIONS TEST
### MAIN STACK--ALL PROCESSES

| | Run 1 04/18/02 | Run 2 04/18/02 | Run 3 04/18/02 | Avg. |
|---|---|---|---|---|
| **Process Conditions--April 2001-March 2002** | | | | |
| Annual Production Rate (tonnes/hr) | 21.474 | 21.474 | 21.474 | 21.474 |
| **Stack Conditions** | | | | |
| Stack Gas Temperature (°F) | 191 | 200 | 206 | 199 |
| Actual Gas Flow (ACFM) | 1,080,402 | 1,087,924 | 1,098,383 | 1,088,903 |
| Std. Gas Flow (DSCFM) | 841,471 | 837,137 | 836,519 | 838,376 |
| Isokinetics (%) | 103.0 | 103.2 | 103.4 | |
| **Emissions, Actual** | | | | |
| Lead (lb/hr) | 20.14 | 20.77 | 27.85 | 22.92 |
| Lead (grams/hr) | 9,135.35 | 9,421.11 | 12,632.54 | 10,396.34 |
| Lead (grams/tonne of lead produced) | 425.41 | 438.72 | 588.27 | 484.14 |
| **Emissions, Allowable** | | | | |
| Lead (grams/tonne of lead produced) | | | | 500.00 |

**Table III: Emission Units that Contribute Gas Flow to the Main Stack**

| Item # | Process[1] Name | Control Device | Gas Volume[2] | Percent of Total |
|---|---|---|---|---|
| 1a[3] | Sinter Machine | #3 Baghouse | 300-350,000 ACFM @ 290°F | 26.3 |
| 1b[3] | Acid Plant | ESP; Acid Demister | 55,000 ACFM @ 175°F | 4.8 |
| 1c[3] | Return Bin | South End Baghouse | 25,000 ACFM @ ambient +5°F | 2.2 |
| 1d[3] | Mixing Drum | Mixing Drum Baghouse | 12,000 ACFM @ ambient +5°F | 1.1 |
| 1e[3] | Claw Breaker; Ross Rolls; Corrugated Rolls; and Euromag | Crusher Baghouse | 45,000 ACFM @ 190°F | 3.9 |
| 1f[3] | Cooler | Cooler baghouse | 110,000 ACFM @ 200°F | 9.6 |
| 1g[3] | Smooth Rolls | Smooth Rolls Baghouse | 15,000 ACFM @ ambient +10°F | 1.3 |
| 2 | Blast Furnaces | #5 baghouse | 500-550,000 ACFM @ ~170°F | 43.8 |
| 3 | Dross Plant | Dross Plant Baghouse | 80,000 ACFM @ ambient +10°F | 7 |
| - | Main Stack Total[4] | All Sources | 1,130,000 ACFM @ ~190°F | 100 |

1 Each process is considered an emission unit for discussion purposes in this test plan.
2 Estimated flow rate based on equipment design specifications.
3 Equipment labeled with #'s 1a thru 1g is all related to the sinter plant operation.
4 Actual total main stack flow is expected to be somewhat lower than the listed as dictated by the specific needs of each process.

As shown in the table, the two exhaust gas streams that dominate the total airflow to the main stack are from the operation of the sinter machine and the operation of the blast furnaces. These two emission units make up 70% or more of the total airflow that is vented to the main stack. About 27% of this is from the sinter machine operation and nearly 44% from operation of the blast furnaces.

## IV. PLANT OPERATING CONDITIONS

Doe Run maintained normal operating conditions during the test period. Raw material processed at the sinter plant was typical of normal material. Acid production and blast furnace operations were also operating at normal conditions. The lead tapped from the furnace represents typical lead normally tapped from the furnace. All aspects of handling, heating, and refining the lead, as well as the final product were representative of normal operation. Therefore, the test data represents normal emissions for those test conditions.

All plant operating conditions were documented by employees of Doe Run familiar with collecting operating data and the operation of the equipment. Operational data is provided in Appendix D.

## V. TEST METHODS, PROCEDURES, AND EQUIPMENT

Each aspect of determining the emission concentrations and flows is described below. A copy of certain procedures and test equipment are provided in Appendix E.

### A. Sampling Location

USEPA Method 1 - Sample and Velocity Traverses for Stationary Sources, was applicable for use in this test program. The sample ports are located in an acceptable location calling for a minimum number of 12 sample points. Three sample points were located at each of four ports.

Method 1 is required for velocity determinations in order to obtain a representative average velocity pressure and sampling of the emission stream. Measurements of the stack dimensions and diameters were recorded as well as the locations of the upstream and downstream disturbances.

Method 1 provides a chart for reference to determine the correct number of sampling points for a given port location relative to disturbances in the stack. The minimum distance allowed is 2 stack diameters downstream from a disturbance, and ½ stack diameter upstream. Meeting this minimum distance, the minimum sampling points are 24. However, if the downstream distance is equal to or greater than eight diameters or more, and the upstream distance is equal to or greater than two diameters or more, then the minimum number of sampling points can be reduced to as few as 12 points. The reason for using distances from disturbances to dictate the number of sampling points is that longer distances will allow the gas flow to stabilize and have a more uniform velocity profile along with a more uniform particle distribution.

There are four, 6" diameter sample ports spaced 90° apart in the stack wall at the platform elevation. The test ports were located over 8 diameters downstream from any disturbance and over 2 diameters upstream from the stack exit. Access for testing at both port locations was made possible by a permanent test platform.

### B. Velocity Determinations

Velocity was monitored and recorded by USEPA Method 2 - "Determination of Stack Gas Velocity And Volumetric Flow Rate (Type S Pitot Tube)". This procedure was performed concurrently with the other sampling as described in Method 5 for particulates.

Method 2 was performed with a pitot attached to a glass lined 12 foot Method 5 sampling probe at sampling points determined in Method 1. The sampling consisted of locating the pitot tube at each sampling point and recording the average velocity pressure (inches water). The velocity

pressure induced by the pitot is displayed by an inclined manometer at each of the 12 sampling points. Each velocity pressure is used to determine the proper sample volume flow rate for that sample point in order to maintain proper isokinetics. The average of the square root values at each point make up the average velocity pressure for one test run.

The velocity pressures obtained by this method were converted to velocity and flow values by considering molecular weight, temperature, and moisture of the sampled gas.

Quality assurance for both procedures included system leak checks before and after the sampling periods. No problems in taking the velocity measurements were encountered throughout the entire test period.

**C. $CO_2$ and $O_2$ Gas Analysis**

Tedlar bag samples were collected simultaneously with the lead test. From these samples, an analysis of the exhaust gases was performed in accordance with USEPA Reference Method 3– "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight".

A separate gas sample is extracted from the stack, by a multi-point, integrated sampling technique. The sample is collected in a chemically inert Tedlar Bag over the duration of the test run. The gas sample is analyzed for percent carbon dioxide ($CO_2$) and percent oxygen ($O_2$) by use of an Orsat.

The sample bags used during the test program were leak checked prior to use. No problems were encountered in performing the gas analysis during the test period.

**D. Moisture Determination**

Moisture analysis of the exhaust gas was performed in accordance with USEPA Reference Method 4 - "Determination of Moisture Content in Stack Gases".

During the Method 12 tests, a portion of the stack gases was extracted and the sample volume was recorded. The amount of moisture in the sample volume was obtained by routing the sample through an ice chilled condenser/dryer and measuring the amount of moisture collected. The temperature of the sample gas leaving the condenser is maintained below 68°F. Moisture determinations were performed by noting the liquid increase in the impingers and the weight gain of the silica gel. No problems were encountered in making the moisture analysis measurements.

**E. Lead Determination**

Sampling followed the procedures described in Method 12 - "Determination of Inorganic Lead Emissions from Stationary Sources", found in Title 40, Part 60, Appendix A, of the Code of Federal Regulations.

Sampling duration was 60 minutes per run during the lead sampling. Sample volumes were significantly above the minimum 30 cubic feet, thereby increasing sensitivity of the detection limits.

A sample was extracted isokinetically (where the probe inlet velocity equals the stack gas velocity at the sample point) in a sampling train similar to the one used in Method 5. Modifications were made to the sample train by loading the impingers with reagents capable of absorbing lead. The lead samples consisted of an analysis of the front half of the sample train, (probe, filter, and all connecting glassware including the filter) and the back half of the sample train (all glassware from the filter to the silica gel impinger including the analysis of the reagents used in the impingers. The first two impingers contained dilute nitric acid used to collect the lead emissions. The third impinger was empty. The fourth impinger contained silica gel used to assure an absolute dry gas leaving the condenser section. Moisture determinations were performed by noting the liquid increase in the impingers and the weight gain of the silica gel. Leak checks of the entire sample trains and velocity trains were performed before and after the test program. No problems were encountered during the lead sampling.

### F. MACT Compliance Determination

The Doe Run Company's Herculaneum smelter is subject to the federal Maximum Achievable Control Technology (MACT) standards. The MACT stack standard is only applicable to the sinter plant, blast furnaces, dross furnace, dross furnace charging area, blast furnace and dross furnace tapping areas, sinter machine charging area, sinter machine discharge, and, sinter crushing equipment emissions that are vented through a control device. In order to determine compliance with this standard, the production and operating time of the previous twelve months must be determined. During the period of April 2001-March 2002, the plant produced 159,494.6 tonnes (megagrams) of lead. No copper matte or copper speiss was produced during the same time frame. Over that time period, the plant had a weighted operating time of 7,422.29 hours. Therefore, the plant had an average production rate of 21.474 tonnes of lead per hour of operation.

In order to meet the MACT standard, a facility must emit less than 500 grams of lead into the atmosphere for every tonne of lead that is produced. The average lead emission rate during the testing program was 10,396.34 grams/hour, which translates into a production-based, lead compound emission rate of 484.14 grams of lead/tonne of lead produced. Consequently, the lead emission rate during the testing demonstrates compliance with the MACT stack standard that is applicable to this facility.

## VI. CONCLUSION

Normal operating conditions that would contribute to normal emissions were maintained during the testing. Therefore, the test data represents normal emissions for the operating conditions at

the time of the tests.

The test results contained in this report demonstrate compliance with the Maximum Achievable Control Technology (MACT) standard for new and existing primary lead smelters regarding lead emissions. All aspects of the testing program were conducted according to the applicable Reference Test Methods. USEPA test methods included Methods 1, 2, 3, 4, and 12, found in Title 40, Part 60, Appendix A, of the Code of Federal Regulations.

ATTACHMENT 5

Facility: DoeRun
Location: Herculaneum, MO
Operator: TC
Date: 12/3/02
Run No.: 1
Sample Box No.: APEX
Meter Box No.: APEX
Meter ΔH: 1.9
C Factor: 1.0
Pitot Coeff ($C_p$): 0.84

#7 Baghouse

Diameter (in.)
Downstream (in.)
Upstream (in.)

Ambient Temp: 33
Barometric Pressure: 29.8
Diameter: 0.21
Leak Rate (cfm): 0.02 @ 15" Hg
Static Pressure: -10.0" $H_2O$
Filter No.: 192
Impinger Vol. (initial): 200
Impinger Vol. (final): 206
Silica Gel Wt. (initial): 406
Silica Gel Wt. (final): 410

Initial Meter Reading: 131.554

6pts/port
2min/point

| Traverse Point No. | Sample Time (min.) | Sample Vacuum (in. Hg) | Stack Temp. (°F) | ΔP in. $H_2O$ | ΔH in. $H_2O$ | Gas Volume ($ft^3$) | DGM Temp. IN | DGM Temp. OUT | Filter Temp. (°F) | Last Impinger (°F) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1032 | 6 | 34 | .65 | 1.4 | 140.7 | 36 | 36 | | 32 |
| 2 | 1034 | 6 | 34 | .65 | 1.4 | 141.9 | 37 | 36 | | 33 |
| 3 | 1036 | 6 | 37 | .75 | 1.6 | 143.2 | 40 | 36 | | 36 |
| 4 | 1038 | 6 | 38 | .75 | 1.6 | 144.7 | 42 | 36 | | 40 |
| 5 | 1040 | 6 | 45 | .75 | 1.6 | 146.3 | 44 | 36 | | 42 |
| 6 | 1042 | 6 | 47 | .70 | 1.5 | 147.2 | 45 | 37 | | 43 |
| 7 | 1044 | 5 | 41 | .60 | 1.4 | 148.4 | 41 | 37 | | 40 |
| 8 | 1046 | 6 | 40 | .75 | 1.6 | 149.6 | 44 | 37 | | 42 |
| 9 | 1048 | 7 | 35 | .80 | 1.7 | 151.2 | 46 | 37 | | 43 |
| 10 | 1050 | 7 | 41 | .80 | 1.7 | 152.4 | 47 | 37 | | 44 |
| 11 | 1052 | 7 | 44 | .90 | 1.9 | 154.0 | 49 | 38 | | 45 |
| 12 | 1054 | 6 | 47 | .75 | 1.6 | 155.3 | 47 | 38 | | 45 |
| 13 | 1056 | 7 | 40 | 1.0 | 2.1 | 156.8 | 43 | 38 | | 41 |
| 14 | 1058 | 7 | 39 | .80 | 1.7 | 158.2 | 47 | 38 | | 43 |
| 15 | 1100 | 6 | 40 | .80 | 1.7 | 159.8 | 48 | 38 | | 43 |
| 16 | 1102 | 6 | 41 | .85 | 1.8 | 161.0 | 50 | 39 | | 44 |
| 17 | 1104 | 6 | 43 | .85 | 1.8 | 162.4 | 50 | 39 | | 43 |
| 18 | 1106 | 6 | 45 | .85 | 1.8 | 163.8 | 51 | 39 | | 43 |
| 19 | 1108 | 8 | 40 | 1.3 | 2.7 | 165.6 | 49 | 39 | | 46 |
| 20 | 1110 | 8 | 40 | 1.3 | 2.7 | 167.2 | 49 | 39 | | 43 |
| 21 | 1112 | 8 | 42 | 1.2 | 2.6 | 168.8 | 51 | 39 | | 43 |
| 22 | 1114 | 8 | 43 | 1.1 | 2.3 | 170.6 | 51 | 40 | | 43 |
| 23 | 1116 | 8 | 45 | 1.1 | 2.3 | 172.2 | 52 | 40 | | 43 |
| 24 | 1118 | 7 | 47 | 1.0 | 2.1 | 173.7 | 52 | 40 | | 42 |
| 25 | 1120 | 6 | 40 | .75 | 1.6 | 175.0 | 44 | 40 | | 40 |
| 26 | 1122 | 6 | 35 | .80 | 1.7 | 176.3 | 48 | 40 | | 41 |
| 27 | 1124 | 6 | 37 | .80 | 1.7 | 177.8 | 49 | 40 | | 41 |
| 28 | 1126 | 6 | 40 | .85 | 1.8 | 179.2 | 51 | 40 | | 41 |
| 29 | 1128 | 6 | 42 | .90 | 1.9 | 180.6 | 51 | 40 | | 41 |
| 30 | 1130 | 6 | 42 | .85 | 1.8 | 182.0 | 51 | 40 | | 41 |

Final Meter Reading: 182.060

Facility Doe Run
Location Herculaneum, MO
Operator TL
Date 12/3/02
Run No. 7
Sample Box No. 19Pesi
Meter Box No. AP2
Meter Δ H@ 1.9
C Factor 1.0
Pitot Coeff ($C_p$) 0.84

#7 Baghouse

Diameter (in.)
Downstream (in.)
Upstream (in.)

Ambient Temp 35
Barometric Pressure 29.8
Diameter 0.21
Leak Rate (cfm) 0.00 @ 15"
Static Pressure ~~-12~~ -10.0 "H2O
Filter No. 1043
Impinger Vol. (initial) 250
Impinger Vol. (final) 272.4
Silica Gel Wt. (initial) 410
Silica Gel Wt. (final) 416

Initial Meter Reading: 182.209

| Traverse Point No. | Sample Time (min.) | Sample Vacuum (in. Hg) | Stack Temp. (°F) | ΔP in. $H_2O$ | ΔH in. $H_2O$ | Gas Volume ($ft^3$) | DGM Temp. IN | DGM Temp. OUT | Filter Temp. (°F) | Last Impinger (°F) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1222/24 | 8 | 40 | 1.3 | 2.7 | 154.0 | 37 | 37 | | 36 |
| 2 | 1226 | 7 | 40 | 1.1 | 2.3 | 185.5 | 37 | 37 | | 38 |
| 3 | 1228 | 8 | 41 | 1.1 | 2.3 | 187.2 | 39 | 37 | | 41 |
| 4 | 1230 | 8 | 41 | 1.1 | 2.3 | 188.9 | 41 | 37 | | 41 |
| 5 | 1232 | 9 | 45 | 1.3 | 2.7 | 190.6 | 42 | 37 | | 42 |
| 6 | 1234 | 9 | 45 | 1.1 | 2.3 | 192.1 | 43 | 37 | | 42 |
| 7 | 1236/38 | 8 | 43 | 1.0 | 2.1 | 193.7 | 41 | 37 | | 40 |
| 8 | 1240 | 8 | 43 | 1.0 | 2.1 | 195.2 | 44 | 37 | | 42 |
| 9 | 1242 | 9 | 44 | 1.1 | 2.3 | 196.8 | 45 | 37 | | 42 |
| 10 | 1244 | 9 | 44 | 1.1 | 2.3 | 198.0 | 47 | 38 | | 42 |
| 11 | 1246 | 9 | 45 | 1.1 | 2.3 | 200.1 | 48 | 38 | | 42 |
| 12 | 1248 | 9 | 47 | 1.1 | 2.3 | 201.7 | 49 | 38 | | 42 |
| 13 | 1250/52 | 8 | 41 | .80 | 1.9 | 203.60 | 43 | 38 | | 41 |
| 14 | 1254 | 8 | 41 | .70 | 1.5 | 204.5 | 46 | 39 | | 41 |
| 15 | 1256 | 8 | 41 | .70 | 1.5 | 205.6 | 47 | 39 | | 41 |
| 16 | 1258 | 7 | 43 | .85 | 1.8 | 207.2 | 48 | 39 | | 41 |
| 17 | 1300 | 7 | 44 | .85 | 1.8 | 208.7 | 49 | 39 | | 41 |
| 18 | 1302 | 7 | 48 | .85 | 1.8 | 210.5 | 50 | 39 | | 41 |
| 19 | 1304/06 | 6 | 44 | .65 | 1.4 | 211.8 | 43 | 39 | | 39 |
| 20 | 1308 | 6 | 44 | .65 | 1.4 | 213.0 | 46 | 39 | | 41 |
| 21 | 1310 | 6 | 40 | .70 | 1.5 | 214.3 | 50 | 40 | | 41 |
| 22 | 1312 | 7 | 41 | .70 | 1.5 | 215.7 | 49 | 39 | | 42 |
| 23 | 1314 | 6 | 46 | .75 | 1.6 | 216.9 | 49 | 40 | | 42 |
| 24 | 1316 | 6 | 46 | .75 | 1.6 | 217.5 | 49 | 40 | | 42 |
| 25 | 1318/20 | 7 | 40 | .50 | 1.1 | 218.7 | 43 | 39 | | 40 |
| 26 | 1322 | 7 | 41 | .70 | 1.5 | 220.0 | 47 | 40 | | 41 |
| 27 | 1324 | 7 | 41 | .65 | 1.4 | 221.2 | 49 | 40 | | 41 |
| 28 | 1326 | 7 | 43 | .70 | 1.5 | 222.4 | 50 | 40 | | 42 |
| 29 | 1328 | 6 | 41 | .75 | 1.6 | 223.1 | 51 | 40 | | 42 |
| 30 | 1330 | 7 | 42 | .75 | 1.6 | 225.0 | 51 | 40 | | 42 |

Final Meter Reading: 225.039

Facility Doe Run
Location Herculaneum, MO
Operator TC
Date 12/3/02
Run No. 3
Sample Box No. APEX
Meter Box No. APEX
Meter Δ H@ 1.9
C Factor 1.0
Pitot Coeff ($C_p$) 0.84

#7 Baghouse

Diameter (in.)
Downstream (in.)
Upstream (in.)

Ambient Temp 35
Barometric Pressure 29.8
Diameter 2.21
Leak Rate (cfm) 0.02 @ 15" Hg
Static Pressure -10" H2O
Filter No. 1942
Impinger Vol. (initial) 200
Impinger Vol. (final) 205
Silica Gel Wt. (initial) 416
Silica Gel Wt. (final) 420

Initial Meter Reading: 275.782

| Traverse Point No: | Sample Time (min.) | Sample Vacuum (in. Hg) | Stack Temp. (°F) | ΔP in. $H_2O$ | ΔH in. $H_2O$ | Gas Volume ($ft^3$) | DGM Temp. IN | DGM Temp. OUT | Filter Temp. (°F) | Last Impinger (°F) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1446/48 | 7 | 38 | .75 | 1.6 | 227.0 | 36 | 35 | | 35 |
| 2 | 1450 | 8 | 38 | 1.0 | 2.1 | 228.8 | 37 | 35 | | 36 |
| 3 | 1452 | 9 | 40 | 1.2 | 2.6 | 230.3 | 40 | 35 | | 38 |
| 4 | 1454 | 9 | 42 | 1.2 | 2.6 | 232.0 | 42 | 35 | | 38 |
| 5 | 1456 | 9 | 44 | 1.2 | 2.6 | 233.6 | 42 | 35 | | 39 |
| 6 | 1458 | 10 | 49 | 1.2 | 2.6 | 235.2 | 43 | 36 | | 39 |
| 7 | 1500/1502 | 8 | 41 | 1.0 | 2.1 | 236.8 | 51 | 36 | | 37 |
| 8 | 1504 | 8 | 42 | 1.0 | 2.1 | 238.4 | 43 | 36 | | 38 |
| 9 | 1506 | 9 | 42 | 1.2 | 2.6 | 240.0 | 43 | 36 | | 38 |
| 10 | 1508 | 9 | 44 | 1.2 | 2.6 | 241.8 | 47 | 36 | | 35 |
| 11 | 1510 | 8 | 46 | 1.1 | 2.3 | 243.4 | 48 | 37 | | 38 |
| 12 | 1512 | 8 | 48 | 1.1 | 2.3 | 245.0 | 48 | 37 | | 38 |
| 13 | 1514/16 | 6 | 41 | .80 | 1.7 | 246.4 | 42 | 37 | | 37 |
| 14 | 1518 | 6 | 38 | .80 | 1.7 | 247.8 | 45 | 37 | | 37 |
| 15 | 1520 | 6 | 38 | .75 | 1.6 | 249.2 | 47 | 38 | | 37 |
| 16 | 1522 | 6 | 40 | .85 | 1.8 | 250.6 | 48 | 38 | | 37 |
| 17 | 1524 | 6 | 43 | .85 | 1.8 | 251.9 | 49 | 38 | 37 | |
| 18 | 1526 | 6 | 48 | .85 | 1.8 | 253.3 | 49 | 38 | 37 | |
| 19 | 1528/30 | 5 | 40 | .60 | 1.3 | 254.5 | 42 | 38 | 36 | |
| 20 | 1532 | 5 | 39 | .60 | 1.3 | 255.8 | 46 | 38 | 36 | |
| 21 | 1534 | 5 | 38 | .65 | 1.4 | 257.1 | 47 | 38 | 37 | |
| 22 | 1536 | 6 | 41 | .85 | 1.8 | 258.5 | 48 | 38 | 37 | |
| 23 | 1538 | 6 | 45 | .85 | 1.8 | 259.8 | 49 | 38 | 37 | |
| 24 | 1540 | 6 | 48 | .85 | 1.8 | 261.1 | 49 | 38 | 37 | |
| 25 | 1542/44 | 7 | 41 | 1.0 | 2.1 | 262.7 | 43 | 38 | 36 | |
| 26 | 1546 | 6 | 37 | .75 | 1.6 | 264.1 | 47 | 38 | 37 | |
| 27 | 1548 | 5 | 37 | .65 | 1.4 | 265.2 | 48 | 39 | 36 | |
| 28 | 1550 | 5 | 38 | .65 | 1.4 | 266.5 | 45 | 39 | 37 | |
| 29 | 1552 | 5 | 43 | .75 | 1.6 | 267.8 | 49 | 39 | 37 | |
| 30 | 1554 | 5 | 47 | .75 | 1.6 | 269.1 | 49 | 39 | 36 | |

Final Meter Reading: 269.138

# BLAST FURNACE FEED DATA SHEET DATE: 12-3-02

BF# 2 SHIFT: Days NAME:

| CO | CHARGE START | CHARGE TIME COKE | CHARGE TIME SINTER | N | S | | CO | CHARGE START | CHARGE TIME COKE | CHARGE TIME SINTER | N | S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | : | 94 3,08 | 100 150 | X | | 31 | 18 | 10:13 | 2914 245 | 3000 201 | | X |
| 10 | : | 188 321 | 200 143 | | X | 32 | | : | 3005 234 | 3100 218 | | X |
| 0 | 4 :59 | 282 341 | 300 159 | X | | 33 | 2 | 11: 31 | 3102 227 | 3200 231 | | X |
| 1 | 5 :05 | 374 302 | 400 245 | | X | 34 | Ø | 12:38 | 3196 223 | 3300 227 | X | |
| 9 | 5 :14 | 470 303 | 500 243 | X | | 35 | 49 | : | 3290 213 | 3400 230 | X | |
| 0 | 5 :24 | 564 307 | 600 213 | | X | 36 | | : | 3384 212 | 3500 231 | | X |
| 0 | 5 :42 | 668 312 | 700 207 | X | | 37 | 61 | 14 :11 | 3478 146 | 3600 58 | X | |
| 25 | 5 :46 | 752 323 | 800 145 | | X | 38 | 47 | 14 :14 | 3572 152 | 3700 161 | X | |
| 0 | 6 :10 | 846 315 | 900 142 | X | | 39 | 57 | 14:18 | 3666 148 | 3800 115 | X | |
| 22 | 6 :19 | 940 304 | 1000 154 | | X | 40 | 67 | 14:23 | 3760 206 | 3900 142 | | X |
| 13 | 6 :43 | 1034 320 | 1100 201 | X | | 41 | 66 | 14 :27 | 3854 140 | 4000 136 | X | |
| 13 | 6 :53 | 1128 316 | 1200 219 | | X | 42 | 52 | 14:30 | 3948 135 | 4100 108 | | X |
| Ø | 7 :17 | 1222 316 | 1300 255 | X | | 43 | 111 | 15 20 | 4042 258 | 4200 403 | X | |
| 9 | 7 :26 | 1316 301 | 1400 344 | | X | 44 | | : | 4136 248 | 4300 241 | X | |
| Ø | 7:36 | 1410 314 | 1500 331 | X | | 45 | 115 | 15:34 | 4230 202 | 4400 239 | | X |
| Ø | 7:51 | 1504 309 | 1600 311 | | X | 46 | 103 | 15:39 | 4324 221 | 4500 253 | | X |
| 0 | 9 :10 | 1598 307 | 1700 308 | X | | 47 | | : | | | | |
| Ø | 8 :32 | 1692 325 | 1800 202 | | X | 48 | | : | | | | |
| Ø | 8 :45 | 1786 428 | 1900 148 | X | | 49 | | : | | | | |
| Ø | 9:11 | 1880 309 | 2000 155 | | X | 50 | | : | | | | |
| Ø | 9:26 | 1914 348 | 2100 207 | X | | 51 | | : | | | | |
| Ø | 9:44 | 2068 236 | 2200 138 | | X | 52 | | : | | | | |
| 10 | 10:13 | 2162 211 | 2300 133 | X | | 53 | | : | | | | |
| 11 | 10:18 | 2256 208 | 2400 127 | | X | 54 | | : | | | | |
| Ø | 10:24 | 2350 210 | 2500 148 | X | | 55 | | : | | | | |
| Ø | 11:13 | 21144 214 | 2600 216 | X | | 56 | | : | | | | |
| Ø | 11:20 | 2538 224 | 2673 700 | | X | 57 | | : | | | | |
| | : | 2632 226 | 2700 75 | | X | 58 | | : | | | | |
| | 11:59 | 2724 245 | 2800 138 | X | | 59 | | : | | | | |
| 28 | 12:06 | 2820 257 | 2900 204 | X | | 60 | | : | | | | |

# BLAST FURNACE FEED DATA SHEET DATE: 12-3-02

BF# 1 SHIFT: Days NAME: S. Adams

| | CHARGE | CHARGE TIME | | | | | | CHARGE | CHARGE TIME | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO | START | COKE | SINTER | N | S | | CO | START | COKE | SINTER | N | S |
| X | : | 1288 | | X | | 31 | | : | | | | |
| Ø | 9:58 | 1505 | | | X | 32 | | : | | | | |
| Ø | 10:07 | 1018 | | X | | 33 | | : | | | | |
| Ø | 10:31 | 1780 | | X | | 34 | | : | | | | |
| Ø | 10:35 | 1838 | 100 152 | | X | 35 | | : | | | | |
| Ø | 10 49 ~~10:40~~ | | 300 228 | X | X | 36 | | : | | | | |
| Ø | 10:49 | 1945 | 300 222 | X | | 37 | | : | | | | |
| Ø | 10:54 | 2058 | 400 141 | X | | 38 | | : | | | | |
| Ø | 11:01 | 2168 | 500 131 | | X | 39 | | : | | | | |
| | : | 2278 | 600 151 | | X | 40 | | : | | | | |
| | : | 1463 | 1100 | X | | 41 | | : | | | | |
| | 1:54 | 1773 2:19 | 1200 2:14 | X | | 42 | | : | | | | |
| | 14:04 | 1883 | 1300 1:16 | | X | 43 | | : | | | | |
| 97 | 14:51 | 1993 | 1400 329 | X | | 44 | | : | | | | |
| 57 | 14:56 | 2052 | 1300 337 | X | | 45 | | : | | | | |
| 9 | 15:10 | 2213 | 1400 320 | | X | 46 | | : | | | | |
| | : | | | | | 47 | | : | | | | |
| | : | | | | | 48 | | : | | | | |
| | : | | | | | 49 | | : | | | | |
| | : | | | | | 50 | | : | | | | |
| | : | | | | | 51 | | : | | | | |
| | : | | | | | 52 | | : | | | | |
| | : | | | | | 53 | | : | | | | |
| | : | | | | | 54 | | : | | | | |
| | : | | | | | 55 | | : | | | | |
| | : | | | | | 56 | | : | | | | |
| | : | | | | | 57 | | : | | | | |
| | : | | | | | 58 | | : | | | | |
| 1 | : | | | | | 59 | | : | | | | |
| | : | | | | | 60 | | : | | | | |

Facility Doe Run
Location Herculaneum, MO
Operator TC
Date 12/4/02
Run No. 1
Sample Box No. APEX
Meter Box No. APEX
Meter Δ H@ 1.9
C Factor 1.0
Pitot Coeff ($C_p$) 0.84

#9 Baghouse

Diameter (in.)
Downstream (in.)
Upstream (in.)

Ambient Temp 30
Barometric Pressure 30.2
Diameter 0.21
Leak Rate (cfm) 0.0 @ 20 "Hg
Static Pressure -10 "H2O
Filter No. 1931
Impinger Vol. (initial) 200
Impinger Vol. (final) 203
Silica Gel Wt. (initial) 430
Silica Gel Wt. (final) 434

Initial Meter Reading: 269.408

| Traverse Point No. | Sample Time (min.) | Sample Vacuum (in. Hg) | Stack Temp. (°F) | ΔP in. $H_2O$ | ΔH in. $H_2O$ | Gas Volume ($ft^3$) | DGM Temp. IN | DGM Temp. OUT | Filter Temp. (°F) | Last Impinger (°F) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1148/50 | 6 | 29 | .85 | 1.8 | 270.8 | 35 | 35 | | 29 |
| 2 | 952 | 6 | 30 | .60 | 1.3 | 272.1 | 36 | 35 | | 29 |
| 3 | 954 | 5 | 32 | .55 | 1.2 | 273.2 | 38 | 35 | | 30 |
| 4 | 956 | 6 | 36 | .70 | 1.5 | 274.4 | 39 | 35 | | 30 |
| 5 | 958 | 7 | 40 | .80 | 1.7 | 275.6 | 41 | 35 | | 31 |
| 6 | 1000 | 7 | 47 | .85 | 1.8 | 277.1 | 42 | 35 | | 30 |
| 7 | 1002/1004 | 5 | 36 | .80 | 1.7 | 278.5 | 39 | 36 | | 30 |
| 8 | 1006 | 5 | 33 | .65 | 1.4 | 279.7 | 42 | 36 | | 31 |
| 9 | 1008 | 5 | 34 | .75 | 1.6 | 281.1 | 43 | 36 | | 31 |
| 10 | 1010 | 5 | 38 | .85 | 1.8 | 282.4 | 45 | 36 | | 31 |
| 11 | 1012 | 5 | 41 | .85 | 1.8 | 283.9 | 46 | 37 | | 32 |
| 12 | 1014 | 5 | 48 | 1.0 | 2.1 | 285.4 | 47 | 37 | | 32 |
| 13 | 1016/1018 | 6 | 38 | .65 | 1.4 | 286.6 | 43 | 37 | | 30 |
| 14 | 1020 | 6 | 35 | .75 | 1.6 | 288.0 | 45 | 37 | | 31 |
| 15 | 1022 | 6 | 37 | .75 | 1.6 | 289.3 | 47 | 38 | | 32 |
| 16 | 1024 | 7 | 40 | .85 | 1.8 | 290.7 | 47 | 37 | | 31 |
| 17 | 1026 | 8 | 44 | 1.0 | 2.1 | 292.3 | 47 | 38 | | 32 |
| 18 | 1028 | 9 | 48 | 1.2 | 2.6 | 293.9 | 48 | 38 | | 32 |
| 19 | 1030/1032 | 6 | 37 | .70 | 1.5 | 295.3 | 41 | 39 | | 30 |
| 20 | 1034 | 7 | 34 | .85 | 1.8 | 296.6 | 45 | 38 | | 31 |
| 21 | 1036 | 7 | 35 | .85 | 1.8 | 298.2 | 47 | 38 | | 32 |
| 22 | 1038 | 8 | 39 | .90 | 1.9 | 299.6 | 47 | 38 | | 32 |
| 23 | 1040 | 8 | 43 | 1.0 | 2.1 | 301.0 | 49 | 39 | | 32 |
| 24 | 1042 | 8 | 46 | 1.0 | 2.1 | 302.5 | 49 | 39 | | 32 |
| 25 | 1044/46 | 7 | 39 | .80 | 1.7 | 303.8 | 43 | 40 | | 31 |
| 26 | 1048 | 7 | 33 | .75 | 1.6 | 305.1 | 47 | 40 | | 32 |
| 27 | 1050 | 7 | 33 | .80 | 1.7 | 306.7 | 47 | 39 | | 31 |
| 28 | 1052 | 8 | 39 | .90 | 1.9 | 307.9 | 49 | 40 | | 32 |
| 29 | 1054 | 8 | 44 | 1.0 | 2.1 | 309.5 | 49 | 39 | | 32 |
| 30 | 1056 | 8 | 43 | 1.0 | 21 | 311.0 | 49 | 39 | | 32 |

Final Meter Reading: 311.061

Facility Herculaneum, MO
Location Doe Run
Operator TC
Date 12/4/02
Run No. 2
Sample Box No. APEX
Meter Box No. APEX
Meter Δ H 1.5
C Factor 1.0
Pitot Coeff ($C_p$) 0.84

#9 Baghouse

Diameter (in.)
Downstream (in.)
Upstream (in.)

Ambient Temp 30
Barometric Pressure 30.2
Diameter 0.21
Leak Rate (cfm) 0.0 @ 20" Hg
Static Pressure -60 " $H_2O$
Filter No. [redacted] 2003
Impinger Vol. (initial) 200
Impinger Vol. (final) 204
Silica Gel Wt. (initial) 434
Silica Gel Wt. (final) 437

Initial Meter Reading: [redacted] 313.657

| Traverse Point No. | Sample Time (min.) | Sample Vacuum (in. Hg) | Stack Temp. (°F) | ΔP in. $H_2O$ | Δn in. $H_2O$ | Gas Volume ($ft^3$) | DGM Temp. IN | DGM Temp. OUT | Filter Temp. (°F) | Last Impinger (°F) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1237/39 | 7 | 27 | .85 | 1.8 | 314.0 | 26 | 27 | | 23 |
| 2 | 1241 | 8 | 26 | .75 | 1.6 | 316.4 | 27 | 26 | | 24 |
| 3 | 1243 | 9 | 28 | .85 | 1.8 | 317.8 | 30 | 26 | | 25 |
| 4 | 1245 | 9 | 32 | .85 | 1.8 | 319.1 | 31 | 27 | | 25 |
| 5 | 1247 | 10 | 37 | 1.0 | 2.1 | 320.6 | 34 | 28 | | 26 |
| 6 | 1249 | 10 | 40 | 1.0 | 2.1 | 322.1 | 35 | 28 | | 27 |
| 7 | 1251/53 | 10 | 33 | 1.1 | 2.3 | 323.7 | 33 | 29 | | 27 |
| 8 | 1255 | 9 | 32 | .85 | 1.8 | 325.2 | 36 | 29 | | 27 |
| 9 | 1257 | 8 | 33 | .75 | 1.6 | 326.5 | 39 | 31 | | 29 |
| 10 | 1259 | 8 | 33 | .75 | 1.6 | 327.7 | 40 | 31 | | 29 |
| 11 | 1301 | 8 | 39 | .80 | 1.7 | 329.0 | 41 | 32 | | 29 |
| 12 | 1303 | 8 | 43 | .80 | 1.7 | 330.4 | 41 | 30 | | 29 |
| 13 | 1305/1307 | 8 | 38 | .80 | 1.7 | 332.3 | 38 | 32 | | 29 |
| 14 | 1309 | 8 | 31 | .75 | 1.6 | 333.6 | 42 | 32 | | 29 |
| 15 | 1311 | 7 | 32 | .65 | 1.4 | 334.9 | 42 | 32 | | 29 |
| 16 | 1313 | 8 | 35 | .75 | 1.6 | 336.2 | 43 | 32 | | 29 |
| 17 | 1315 | 9 | 42 | .90 | 1.9 | 337.6 | 44 | 33 | | 29 |
| 18 | 1317 | 10 | 45 | 1.0 | 2.1 | 339.0 | 45 | 34 | | 29 |
| 19 | 1319/1321 | 10 | 39 | 1.0 | 2.1 | 340.7 | 38 | 34 | | 29 |
| 20 | 1323 | 8 | 36 | .70 | 1.5 | 341.9 | 43 | 34 | | 30 |
| 21 | 1325 | 8 | 35 | .70 | 1.5 | 343.2 | 44 | 34 | | 30 |
| 22 | 1327 | 8 | 37 | .75 | 1.6 | 344.5 | 44 | 34 | | 30 |
| 23 | 1329 | 9 | 43 | .90 | 1.9 | 345.9 | 45 | 34 | | 30 |
| 24 | 1331 | 10 | 46 | 1.0 | 2.1 | 347.4 | 46 | 35 | | 30 |
| 25 | 1333/35 | 9 | 36 | .90 | 1.9 | 349.1 | 40 | 34 | | 30 |
| 26 | 1337 | 8 | [redacted]33 | .70 | 1.5 | 350.3 | 42 | 34 | | 30 |
| 27 | 1339 | 7 | 34 | .60 | 1.3 | 351.5 | 43 | 35 | | 30 |
| 28 | 1341 | 7 | 37 | .60 | 1.3 | 352.6 | 43 | 35 | | 30 |
| 29 | 1343 | 8 | 44 | .70 | 1.5 | 353.8 | 45 | 35 | | 30 |
| 30 | 1345 | 8 | 48 | .70 | 1.5 | 355.1 | 45 | 35 | | 30 |

Final Meter Reading: 355.180

Facility Doe Run
Location Herculaneum, Mo
Operator JC
Date 12/4/02
Run No. 3
Sample Box No. APEX
Meter Box No. APEX
Meter Δ H@ 1.9
C Factor 1.0
Pitot Coeff ($C_p$) 0.84

#9 Baghouse

Diameter (in.)
Downstream (in.)
Upstream (in.)

Ambient Temp 30
Barometric Pressure 30.2
Diameter 0.21
Leak Rate (cfm) 0.0 @ 15" Hg
Static Pressure -10" $H_2O$
Filter No. 2004
Impinger Vol. (initial) 200
Impinger Vol. (final) 204
Silica Gel Wt. (initial) 470
Silica Gel Wt. (final) 473

Initial Meter Reading: 355.516

| Traverse Point No. | Sample Time (min.) | Sample Vacuum (in. Hg) | Stack Temp. (°F) | ΔP in. $H_2O$ | ΔH in. $H_2O$ | Gas Volume ($ft^3$) | DGM Temp. IN | DGM Temp. OUT | Filter Temp. (°F) | Last Impinger (°F) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1456/58 | 8 | 28 | .95 | 2.0 | 356.7 | 27 | 27 | | 27 |
| 2 | 1500 | 6 | 29 | .70 | 1.5 | 358.1 | 29 | 28 | | 32 |
| 3 | 1502 | 6 | 31 | .75 | 1.6 | 359.3 | 30 | 28 | | 34 |
| 4 | 1504 | 8 | 34 | .90 | 1.9 | 360.8 | 33 | 30 | | 35 |
| 5 | 1506 | 8 | 41 | 1.0 | 2.1 | 362.3 | 35 | 28 | | 35 |
| 6 | 1508 | 8 | 45 | 1.1 | 2.3 | 363.9 | 37 | 29 | | 37 |
| 7 | 1510/1512 | 7 | 36 | .85 | 1.8 | 365.1 | 35 | 30 | | 35 |
| 8 | 1514 | 5 | 34 | .75 | 1.6 | 366.5 | 37 | 30 | | 36 |
| 9 | 1516 | 6 | 33 | .80 | 1.7 | 367.9 | 39 | 30 | | 36 |
| 10 | 1518 | 6 | 35 | .90 | 1.9 | 369.3 | 40 | 30 | | 36 |
| 11 | 1520 | 7 | 41 | 1.0 | 2.1 | 370.8 | 42 | 31 | | 36 |
| 12 | 1522 | 8 | 46 | 1.1 | 2.3 | 372.4 | 43 | 31 | | 37 |
| 13 | 1524/1526 | 6 | 35 | .80 | 1.7 | 373.8 | 26 | 32 | | 33 |
| 14 | 1528 | 5 | 32 | .65 | 1.4 | 375.0 | 40 | 32 | | 36 |
| 15 | 1530 | 5 | 33 | .65 | 1.4 | 376.3 | 41 | 32 | | 36 |
| 16 | 1532 | 6 | 37 | .80 | 1.7 | 377.6 | 43 | 32 | | 36 |
| 17 | 1534 | 6 | 40 | .85 | 1.8 | 379.0 | 44 | 32 | | 36 |
| 18 | 1536 | 7 | 43 | .95 | 2.0 | 380.5 | 45 | 33 | | 36 |
| 19 | 1538/1540 | 7 | 38 | .90 | 1.9 | 382.0 | 38 | 33 | | 34 |
| 20 | 1542 | 6 | 33 | .80 | 1.7 | 383.3 | 44 | 33 | | 36 |
| 21 | 1544 | 6 | 32 | .70 | 1.5 | 384.6 | 44 | 33 | | 35 |
| 22 | 1546 | 6 | 36 | .80 | 1.7 | 386.0 | 45 | 34 | | 36 |
| 23 | 1548 | 6 | 42 | .80 | 1.7 | 387.4 | 46 | 34 | | 36 |
| 24 | 1550 | 6 | 47 | .90 | 1.9 | 388.8 | 46 | 34 | | 36 |
| 25 | 1552/54 | 7 | 39 | 1.0 | 2.1 | 390.5 | 39 | 34 | | 34 |
| 26 | 1556 | 6 | 36 | .70 | 1.5 | 391.8 | 44 | 34 | | 35 |
| 27 | 1558 | 5 | 37 | .55 | 1.2 | 392.9 | 44 | 35 | | 36 |
| 28 | 1600 | 7 | 41 | .65 | 1.4 | 393.4 | 45 | 35 | | 36 |
| 29 | 1602 | 7 | 47 | .65 | 1.4 | 394.6 | 45 | 34 | | 36 |
| 30 | 1604 | 7 | 48 | .65 | 1.4 | 395.9 | 45 | 34 | | 36 |

Final Meter Reading: 395.900

IN PROCESS 12-4-02 DAY SHIFT AND CASTED

# LOT CONTROL CARD

# LOT NUMBER 7740

*DROSS FURNACE KETTLE#:* _____ *DATE:* 12-2-02

Vacuum zinc added? Yes____ No____

Amount of new zinc added for desilverizing 0 lbs

Was silver assay on pre-zinc sample high enough to make stubs? Yes____ No N

If yes, how many stubs did you make? 0

Was de-zinc kettle temperature between 950 and 1100 F Yes Y No____

Based on the tail sample, was this kettle successfully dezinced? Yes Y No____

What product are you making? DRI What pump? 19

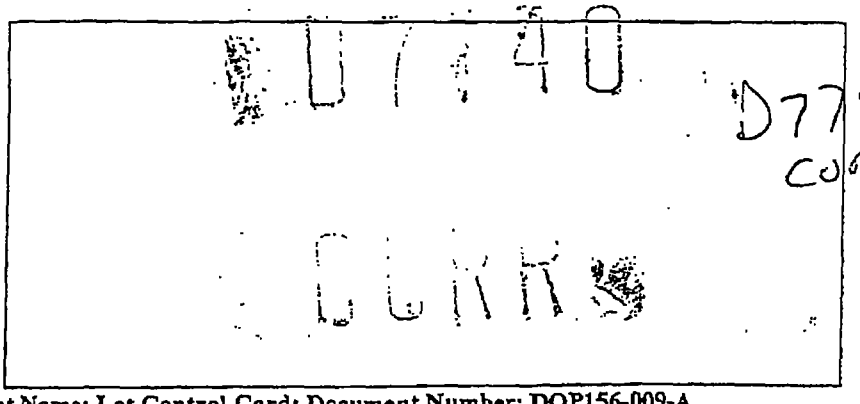
During casting, estimate amount of lead scrapped due to any reason. 4 Tons

What problems occurred while casting? _____

7740

| Work Order # | Description | Completed |
|---|---|---|
| _____ | _____ | Y N |
| _____ | _____ | Y N |
| _____ | _____ | Y N |
| _____ | _____ | Y N |

STAMPING:



Facility Doe Run
Location Herculaneum, MO
Operator TC
Date 12/5/02
Run No. 1
Sample Box No. APEX
Meter Box No. APEX
Meter Δ H, 1.9
C Factor 1.0
Pitot Coeff ($C_p$) 0.84

#8 Baghouse

Diameter (in.)
Downstream (in.)
Upstream (in.)

Ambient Temp 35
Barometric Pressure 30.1
Diameter 0.29
Leak Rate (cfm) 0.0 @ 10" Hg
Static Pressure -0.2" $H_2O$
Filter No. 3005
Impinger Vol. (initial) 200
Impinger Vol. (final) 201
Silica Gel Wt. (initial) 494
Silica Gel Wt. (final) 487

Initial Meter Reading: 396.248

| Traverse Point No. | Sample Time (min.) | Sample Vacuum (in. Hg) | Stack Temp. (°F) | ΔP in. $H_2O$ | ΔH in. $H_2O$ | Gas Volume ($ft^3$) | DGM Temp. IN | DGM Temp. OUT | Filter Temp. (°F) | Last Impinger (°F) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 10~~15~~/~~18.5~~ | 4 | 51 | .19 | 1.5 | 397.8 | 37 | 35 | | 42 |
| 2 | 1020 | 4 | 53 | .17 | 1.3 | 399.2 | 38 | 35 | | 43 |
| 3 | 1022.5 | 3 | 54 | .15 | 1.2 | 400.6 | 41 | 35 | | 44 |
| 4 | 1025 | 3 | 51 | .15 | 1.2 | 402.3 | 43 | 36 | | 43 |
| 5 | 1027.5 | 3 | 57 | .15 | 1.2 | 403.7 | 45 | 36 | | 43 |
| 6 | 1030 | 3 | 51 | .13 | 1.0 | 404.9 | 46 | 37 | | 42 |
| 7 | 1031.5 | 3 | 52 | .13 | 1.0 | 406.2 | 47 | 37 | | 41 |
| 8 | 1035 | 3 | 54 | .13 | 1.0 | 406.5 | 48 | 37 | | 41 |
| 9 | 1037.5 | 3 | 56 | .13 | 1.0 | 408.0 | 48 | 38 | | 40 |
| 10 | 1040 | 3 | 56 | .15 | 1.2 | 410.3 | 50 | 38 | | 39 |
| 11 | 1042.5 | 5 | 57 | .21 | 1.6 | 412.0 | 51 | 39 | | 40 |
| 12 | 1045 | 5 | 57 | .21 | 1.6 | 413.7 | 52 | 39 | | 40 |
| 13 | ~~1047.5~~ 1042.5 | 4 | 52 | .19 | 1.5 | 415.4 | 45 | 39 | | 38 |
| 14 | 1052.5 | 5 | 50 | .21 | 1.6 | 417.0 | 50 | 39 | | 38 |
| 15 | 1055 | 4 | 50 | .17 | 1.3 | 418.4 | 51 | 39 | | 39 |
| 16 | 1057.5 | 3 | 50 | .15 | 1.2 | 420.0 | 51 | 39 | | 38 |
| 17 | 1100 | 3 | 51 | .13 | 1.0 | 421.2 | 51 | 40 | | 38 |
| 18 | 1102.5 | 3 | 51 | .13 | 1.0 | 422.6 | 51 | 40 | | 37 |
| 19 | 1105 | 4 | 53 | .15 | 1.2 | 424.0 | 51 | 40 | | 37 |
| 20 | 1107.5 | 4 | 56 | .19 | 1.5 | 425.2 | 51 | 40 | | 37 |
| 21 | 1110 | 5 | 54 | .25 | 1.9 | 427.7 | 51 | 40 | | 37 |
| 22 | 1112.5 | 4 | 53 | .33 | 2.5 | 429.6 | 51 | 40 | | 37 |
| 23 | 1115 | 4 | 52 | .25 | 1.9 | 431.3 | 51 | 40 | | 37 |
| 24 | 1117.5 | 5 | 50 | .35 | 2.7 | 433.6 | 51 | 40 | | 37 |

Final Meter Reading: 433.652

881 MAIN STREET
HERCULANEUM, MO 63048
Phone: (636) 933-3097
Fax: (636) 933-3150

**The DOE RUN Company**

# Fax

To: SCOTT POSTMA From: RUSTY KELLER

Fax: 913 551 9048 Pages: 17

Phone: 913 551 7048 Date: 12-9-02

Re: Herculaneum STACK TESTING CC:

☐ Urgent ☑ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

• Comments:

#7, #8, #9, Bghse TEST data.

Facility Doe Run
Location Herculaneum, MO
Operator TC
Date 12/5/02
Run No. 2
Sample Box No. APEX
Meter Box No. APEX
Meter Δ H@ 1.9
C Factor 1.0
Pitot Coeff ($C_p$) 0.84

#8 Baghouse

Diameter (in.)
Downstream (in.)
Upstream (in.)

Ambient Temp 35
Barometric Pressure 30.1
Diameter 0.29
Leak Rate (cfm)
Static Pressure +0.74 in $H_2O$
Filter No. 30010
Impinger Vol. (initial) 200
Impinger Vol. (final) 201
Silica Gel Wt. (initial) 487
Silica Gel Wt. (final) 491

Initial Meter Reading: 433.928

| Traverse Point No. | Sample Time (min.) | Sample Vacuum (in. Hg) | Stack Temp. (°F) | ΔP in. $H_2O$ | ΔH in. $H_2O$ | Gas Volume ($ft^3$) | DGM Temp. IN | DGM Temp. OUT | Filter Temp. (°F) | Last Impinger (°F) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1150/15 | 4 | 48 | .13 | 1.0 | 435.2 | 37 | 37 | | 38 |
| 2 | 1155 | 4 | 51 | .15 | 1.2 | 436.7 | 39 | 37 | | 39 |
| 3 | 1157.5 | 4 | 53 | .13 | 1.0 | 438.1 | 42 | 37 | | 40 |
| 4 | 1200 | 4 | 53 | .13 | 1.0 | 439.4 | 44 | 37 | | 41 |
| 5 | 1202.5 | 4 | 54 | .15 | 1.2 | 441.0 | 45 | 37 | | 41 |
| 6 | 1205 | 4 | 55 | .15 | 1.2 | 442.3 | 47 | 37 | | 41 |
| 7 | 1207.5 | 4 | 56 | .15 | 1.2 | 443.9 | 48 | 38 | | 41 |
| 8 | 1210 | 5 | 57 | .23 | 1.8 | 445.6 | 49 | 38 | | 41 |
| 9 | 1212.5 | 6 | 58 | .27 | 2.1 | 447.0 | 51 | 38 | | 41 |
| 10 | 1215 | 6 | 60 | .25 | 1.9 | 448.5 | 51 | 38 | | 40 |
| 11 | 1217.5 | 6 | 62 | .31 | 2.4 | 451.4 | 52 | 39 | | 39 |
| 12 | 1220 | 6 | 60 | .35 | 2.9 | 453.6 | 52 | 39 | | 39 |
| 13 | 1221/3.5 | 4 | 62 | .17 | 1.3 | 455.0 | 44 | 38 | | 40 |
| 14 | 1226 | 4 | 62 | .17 | 1.3 | 456.6 | 50 | 40 | | 40 |
| 15 | 1228.5 | 4 | 59 | .15 | 1.2 | 458.4 | 51 | 40 | | 41 |
| 16 | 1231 | 4 | 57 | .15 | 1.2 | 459.8 | 51 | 40 | | 41 |
| 17 | 1233.5 | 4 | 57 | .15 | 1.2 | 461.0 | 52 | 40 | | 42 |
| 18 | 1236 | 4 | 57 | .15 | 1.2 | 462.3 | 52 | 40 | | 42 |
| 19 | 1238.5 | 4 | 57 | .13 | 1.0 | 463.4 | 52 | 40 | | 43 |
| 20 | 1241 | 4 | 57 | .13 | 1.0 | 465.1 | 52 | 41 | | 43 |
| 21 | 1243.5 | 4 | 57 | .19 | 1.5 | 466.7 | 52 | 41 | | 43 |
| 22 | 1246 | 4 | 57 | .19 | 1.5 | 468.4 | 52 | 41 | | 44 |
| 23 | 1248.5 | 4 | 57 | .19 | 1.5 | 470.1 | 52 | 41 | | 44 |
| 24 | 1251 | 4 | 57 | .19 | 1.5 | 471.6 | 52 | 41 | | 44 |

Final Meter Reading: 471.651

Facility: Doe Run
Location: Herculaneum, Mo
Operator: TC
Date: 12/5/02
Run No.: 3
Sample Box No.: APEX
Meter Box No.: APEX
Meter Δ H: 1.9
C Factor: 1.0
Pitot Coeff ($C_p$): 0.84

#8 Baghouse

Diameter (in.):
Downstream (in.):
Upstream (in.):

Ambient Temp: 35
Barometric Pressure: 30.1
Diameter: 0.29
Leak Rate (cfm): 0.010 @ 16" Hg
Static Pressure: +0.22" $H_2O$
Filter No.: 3002
Impinger Vol. (initial): 200
Impinger Vol. (final): 202
Silica Gel Wt. (initial): 454
Silica Gel Wt. (final): 456

Initial Meter Reading: 471.352

| Traverse Point No. | Sample Time (min.) | Sample Vacuum (in. Hg) | Stack Temp. (°F) | ΔP in. $H_2O$ | ΔH in. $H_2O$ | Gas Volume ($ft^3$) | DGM Temp. IN | DGM Temp. OUT | Filter Temp. (°F) | Last Impinger (°F) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1350/2.5 | 4 | 49 | .17 | 1.3 | 473.3 | 36 | 36 | | 39 |
| 2 | 1455 | 4 | 48 | .15 | 1.2 | 474.8 | 37 | 36 | | 39 |
| 3 | 1357.5 | 4 | 47 | .15 | 1.2 | 476.3 | 40 | 36 | | 40 |
| 4 | 1400 | 4 | 48 | .15 | 1.2 | 477.8 | 42 | 36 | | 40 |
| 5 | 1402.5 | 4 | 49 | .15 | 1.2 | 479.3 | 43 | 36 | | 39 |
| 6 | 1405 | 4 | 50 | .15 | 1.2 | 480.3 | 45 | 36 | | 39 |
| 7 | 1407.5 | 4 | 51 | .19 | 1.5 | 482.3 | 46 | 36 | | 38 |
| 8 | 1410 | 4 | 54 | .17 | 1.3 | 483.7 | 46 | 37 | | 38 |
| 9 | 1412.5 | 4 | 56 | .17 | 1.3 | 485.3 | 47 | 37 | | 38 |
| 10 | 1415 | 5 | 57 | .17 | 1.3 | 486.6 | 47 | 37 | | 38 |
| 11 | 1417.5 | 5 | 58 | .21 | 1.6 | 488.5 | 47 | 37 | | 38 |
| 12 | 1420 | 5 | 58 | .21 | 1.6 | 490.1 | 48 | 38 | | 38 |
| 13 | 1422.5 | 5 | 58 | .13 | 1.0 | 491.5 | 43 | 38 | | 40 |
| 14 | 1426 | 5 | 55 | .15 | 1.2 | 492.7 | 44 | 38 | | 41 |
| 15 | 1428.5 | 5 | 54 | .15 | 1.2 | 494.2 | 46 | 37 | | 39 |
| 16 | 1431 | 4 | 54 | .15 | 1.2 | 496.0 | 47 | 37 | | 38 |
| 17 | 1433.5 | 5 | 55 | .15 | 1.2 | 497.2 | 48 | 38 | | 37 |
| 18 | 1436 | 6 | 54 | .17 | 1.3 | 498.6 | 48 | 38 | | 37 |
| 19 | 1438.5 | 5 | 52 | .17 | 1.3 | 500.2 | 48 | 38 | | 37 |
| 20 | 1441 | 5 | 52 | .23 | 1.8 | 501.9 | 48 | 38 | | 37 |
| 21 | 1443.5 | 5 | 50 | .25 | 1.9 | 503.8 | 48 | 38 | | 37 |
| 22 | 1446 | 5 | 50 | .25 | 1.9 | 505.7 | 48 | 38 | | 37 |
| 23 | 1448.5 | 5 | 51 | .25 | 1.9 | 507.4 | 48 | 38 | | 37 |
| 24 | 1451 | 5 | 50 | .31 | 2.4 | 509.4 | 48 | 38 | | 37 |

Final Meter Reading: 509.477

IN PROCESS 12-5-02 DAY SHIFT

# LOT CONTROL CARD

IN PROCESS 12-5-02 DAY SHIFT AND CASTED

# LOT NUMBER 7741

*DROSS FURNACE KETTLE#:* _____ *DATE:* 12-2-02

Vacuum zinc added? Yes____ No X

Amount of new zinc added for desilverizing 2056 lbs

Was silver assay on pre-zinc sample high enough to make stubs? Yes X No ~~X~~

If yes, how many stubs did you make? ~~8~~ 16

Was de-zinc kettle temperature between 950 and 1100 F Yes____ No____

Based on the tail sample, was this kettle successfully dezinced? Yes____ No____

What product are you making? _____ What pump? _____

During casting, estimate amount of lead scrapped due to any reason. _____ Tons

What problems occurred while casting? _____

| Work Order # | Description | Completed |
|---|---|---|
| | | Y N |
| | | Y N |
| | | Y N |
| | | Y N |

**STAMPING:**

D 7741 8
D 7241 J. White
CORR

**Document Name: Lot Control Card; Document Number: DQP156-009-A**
**Effective Date: 05/01/2000, Revision #5**

IN PROCESS 12-7-02 DAY SHIFT

# LOT CONTROL CARD

IN PROCESS 12-5-02 DAY SHIFT AND DATED

# LOT NUMBER 7742

*DROSS FURNACE KETTLE#:* _____ *DATE:* 12-3-02

Vacuum zinc added? Yes____ No ✓

Amount of new zinc added for desilverizing 4012 lbs

Was silver assay on pre-zinc sample high enough to make stubs? Yes ✓ No____

If yes, how many stubs did you make? 12

Was de-zinc kettle temperature between 950 and 1100 F Yes X No____

Based on the tail sample, was this kettle successfully dezinced? Yes X No____

What product are you making? 1500A1 60 What pump? _____

During casting, estimate amount of lead scrapped due to any reason. _____ Tons

What problems occurred while casting? _____

2nLL

| Work Order # | Description | Completed |
|---|---|---|
| _____ | _____ | Y N |
| _____ | _____ | Y N |
| _____ | _____ | Y N |
| _____ | _____ | Y N |

**STAMPING:**

C 7742

1500 L

1700

# BLAST FURNACE FEED DATA SHEET DATE: 12-5-02

BF# 1 SHIFT: Days NAME:

| CO | CHARGE START | CHARGE TIME COKE | CHARGE TIME SINTER | N | S | CO | CHARGE START | CHARGE TIME COKE | CHARGE TIME SINTER | N | S |
|---|---|---|---|---|---|---|---|---|---|---|---|
| [illegible] | 5:09 | 105 | 100 352 | | | 31 | 220 | : 3325 — | 3200 55 | | X |
| [illegible] | 5:18 | 210 | 300 351 | | | 32 | 233 | : 3478 — | 3300 117 | X | |
| 239 | 5:47 | 915 | 900 259 | X | | 33 | 233 | : 3581 — | 3400 136 | | X |
| 120 | 5:55 | 4120 | 4100 252 | | X | 34 | 320 | : 3683 — | 3500 140 | X | |
| 220 | 6:42 | 525 | 500 232 | X | | 35 | | : | | | |
| 350 | 6:49 | 1630 | 1600 [illegible] | | X | 36 | | : | | | |
| [illegible] | 7:57 | 733 | 700 251 | | | 37 | | : | | | |
| [illegible] | 8:00 | 330 | 300 217 | | X | 38 | | : | | | |
| [illegible] | 8:07 | 939 | 900 245 | | | 39 | | : | | | |
| [illegible] | 8:21 | 1042 | [illegible] | X | | 40 | | : | | | |
| [illegible] | : | 1145 | 1100 [illegible] | | | 41 | | : | | | |
| [illegible] | [illegible] | 1248 | 1200 310 | | | 42 | | : | | | |
| [illegible] | [illegible] | 1351 | 1300 312 | | | 43 | | : | | | |
| | : | 1454 | 1400 248 | | | 44 | | : | | | |
| 232 | 9:46 | 1557 | 1500 331 | X | | 45 | | : | | | |
| 183 | 10:09 | 1660 | 1600 453 | | X | 46 | | : | | | |
| 248 | 10:41 | 1933 | 1800 137 | X | | 47 | | : | | | |
| 242 | 10:49 | 2036 | 1900 143 | | X | 48 | | : | | | |
| 259 | 11:20 | 2139 | 2000 158 | X | | 49 | | : | | | |
| 228 | 11:27 | 2242 | 2100 134 | | X | 50 | | : | | | |
| 240 | 11:51 | 2345 | 2200 124 | X | | 51 | | : | | | |
| 224 | 12:10 | 2448 | 2300 123 | | X | 52 | | : | | | |
| 218 | 12:25 | 2551 | 2400 140 | X | | 53 | | : | | | |
| 254 | 12:43 | 2654 | 2500 133 | X | | 54 | | : | | | |
| 233 | 12:56 | 2757 | 2600 126 | | X | 55 | | : | | | |
| 318 | 1:15 | 2860 | 2700 123 | X | | 56 | | : | | | |
| 250 | 1:30 | 2963 | 2800 121 | | X | 57 | | : | | | |
| | : | 3066 | 2900 116 | X | | 58 | | : | | | |
| | : | 3169 | 3000 117 | | X | 59 | | : | | | |
| 270 | 2:25 | 3272 | 3100 118 | X | | 60 | | : | | | |

TOTAL FEED FOR EACH 100 CLICKS = 10 TONS

COKE FUEL EACH CLICK = 20 pounds

# BLAST FURNACE FEED DATA SHEET DATE: 12-9-02

BF# #1 & 2 SHIFT: Day NAME: J Adams

| | CHARGE | 20 #/cbl CHARGE TIME (ea. 10th chg = 10 Tons) | | | | | CHARGE | CHARGE TIME | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO | START | COKE | SINTER | N | S | | CO | START | COKE | SINTER | N S |
| 210 | 4:00 | 94 201 | 1000 214 | X | | 31 | | : | | | |
| | : | 188 210 | 200 | | X | 32 | | : | | | |
| | : | 282 211 | 300 325 | | X | 33 | | : | | | |
| | : | 376 204 | 400 341 | X | | 34 | | : | | | |
| 256 | 5:28 | 470 210 | 500 349 | | X | 35 | | : | | | |
| 267 | 5:36 | 564 211 | 600 314 | X | | 36 | | : | | | |
| 116 | 6:05 | 658 152 | 700 202 | X | | 37 | | : | | | |
| 123 | 6:14 | 752 | 800 240 | | X | 38 | | : | | | |
| 119 | 6:27 | 846 158 | 900 244 | | X | 39 | | : | | | |
| 112 | 6:34 | 940 210 | 1000 230 | X | | 40 | | : | | | |
| 166 | 7:00 | 1034 247 | 1100 215 | X | | 41 | | : | | | |
| 166 | 7:07 | 1128 231 | 1200 | | X | 42 | | : | | | |
| 208 | 7:31 | 1222 | 1300 | | X | 43 | | : | | | |
| 241 | 7:55 | | | X | | 44 | | : | | | |
| | : | | | | | 45 | | : | | | |
| | : | | | | | 46 | | : | | | |
| | : | | | | | 47 | | : | | | |
| | : | | | | | 48 | | : | | | |
| | : | | | | | 49 | | : | | | |
| | : | | | | | 50 | | : | | | |
| | : | | | | | 51 | | : | | | |
| | : | | | | | 52 | | : | | | |
| | : | | | | | 53 | | : | | | |
| | : | | | | | 54 | | : | | | |
| | : | | | | | 55 | | : | | | |
| | : | | | | | 56 | | : | | | |
| | : | | | | | 57 | | : | | | |
| | : | | | | | 58 | | : | | | |
| | : | | | | | 59 | | : | | | |
| | : | | | | | 60 | | : | | | |